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Development of Battery Operated Portable Ventilator Using AMBU Bag for Emergency Oxygen Supply

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ABSTRACT
In this paper a battery operated portable ventilator using AMBU bag in presented. The proposed ventilator can measure oxygen saturation and heart pulse of the patient along with conventional oxygen supply. Lever and crank mechanism is used to push the AMBU (Artificial Manual Breathing Unit) bag with the help of dc motor. MOSFET is used as a switch to control the motor operation. The control signal to MOSFET is given from ESP8266.

Keywords—AMBU bag, DC motor, ESP8266, Oximeter, LCD Display, Driver circuit etc.

1.Introduction

Ventilators are one of the most important devices to keep Patients with breathing problem, in most critical condition, alive. As global demand for Ventilators is increasing and there is shortage of Ventilators in our country as well, also managing patients during this time is big task, battery operated portable Ventilator using AMBU (Artificial Manual Breathing Unit)bag is developed which supply oxygen to the patients and also measures BP and oxygen saturation (SPO2) of patients and visible on LCD Display and Android BlynkApp. The conventional ventilator is improved with the above additional features and the prototype of the same is developed. It can be used for emergency purpose in Hospitals, quarantine coaches, isolationwards, accident sites and rural areas as well. The shortage of Ventilators can be met effectively by developing this prototype. This project is low cost yet effective Ventilating system. This system uses an AMBU resuscitator which is pushed using gear box that is driven by DC Motor. The whole design is assembled in a box which can be easily lifted and transported. The product can be operatedby less skilled person also.

2.Methodology

Initially AC Supply is given to the system, whole system works on DC Source 5V Supply So Rectifier is used which converts AC to DC and Regulator is used to set required voltage that is5V. Then Regulator is connected to ESP8266 Microcontroller which has inbuilt Wi-Fi. Driver circuit is used to control motor where driver circuit draws maximum current of 0.5Amps. To push the AMBU bag it requires more load about 1 to 2 Amps So we are using MOSFET (Metal Oxide Semiconductor Field Effect Transistor) which draws up to 5 to 6 Amps. When signal passes to the driver circuit then it Switches the MOSFET which works as a switch to DCmotor.

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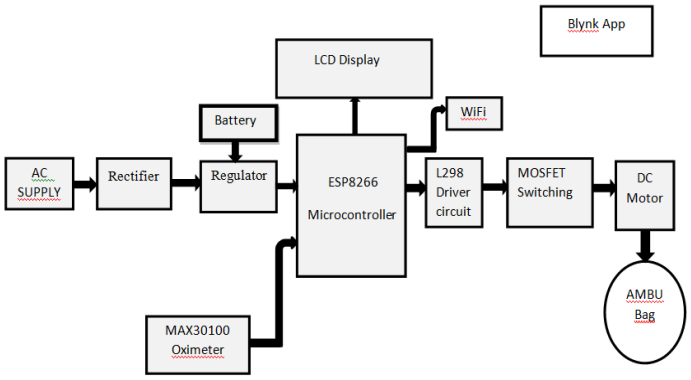

Fig.1 Block diagram of portable ventilator using AMBU bag

3.Circuit diagram

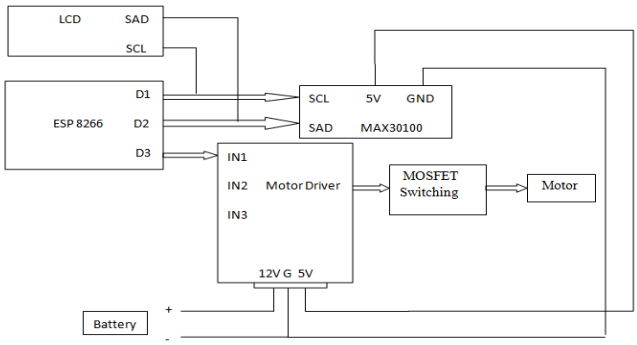

Fig. 2 Circuit diagram of portable ventilator using AMBU bag

4.components

AMBUBag

- Inspiratory resistance:0.37kPa
- Expiratory resistance:0.45kPa ApplicationTemperature:-18to50^{o}C.
- Bag volume:1500ml.

A bag valve mask (BVM), sometimes known by the proprietary name AMBU (Artificial Manual Breathing Unit) bag or generically as a manual resuscitator.

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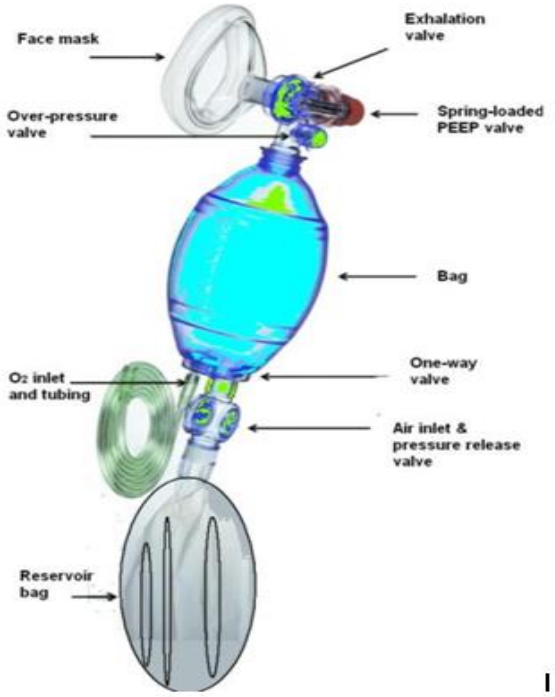

Fig. 3 AMBU bag

ESP8266

- Operatingvoltage: 3.3V(DC)
- Inputvoltage: 4.5Vto10V.
- Type:32bitMicrocontroller.
- Flashmemory:4MB/64KB
- Digitalinputpins:16
- Analoginputpins:1
- 128KBRAM.

Node MCU has inbuilt WiFi.

Fig.4 ESP8266

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Driver Circuit(L298N)

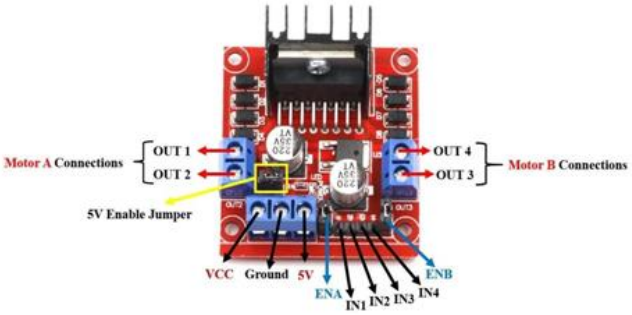

Fig. 5 Driver circuit

The L298 Based Motor Driver Module is used to control the MOSFET circuit and DC Motor.
MOSFET(IRF540)

Fig. 6 MOSFET

- Small signal N-ChannelMOSFET.
- ContinuousDrainCurrentis33Aat25ºC.
- PulseDrainCurrentis110A.
- MinimumGatethresholdvoltageis2V.
- GatesourceVoltageis±20V.
- MaximumDrain-SourceVoltageis100V..

DC MOTOR

Fig.7 DC motor

DC Motor-100RPM-12Volts-1A.
The DC Motor is used to push the AMBU Bag.

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OXIMETER

Fig. 8: Oximeter

- Working Voltage: 1.8Vto 5.5V.
- Shutdowncurrent:0.7microamperes.

5.EXPERIMENTAL VIEW

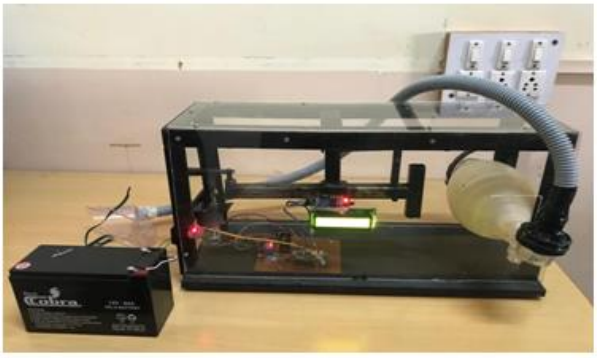
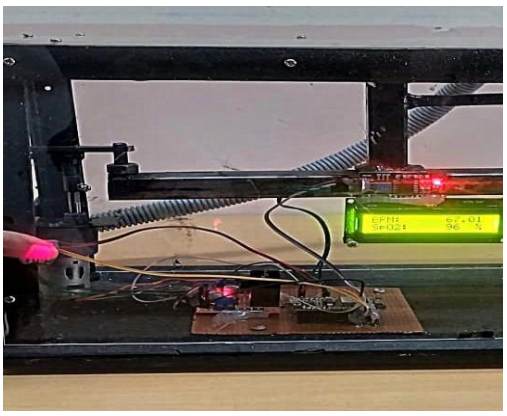


Fig. 9 Experimental setup of portable ventilator using AMBU bag

6. RESULT

On LCD display its BPM (heart beat rate per minute) and SPO_2 oxygen level of the patient.



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7. CONCLUSION

The lack of adequate ventilator support has already caused deaths in the first and second wave ofCOVID-19 pandemic and more can be expected unless ventilators can quickly be provided to areas overburdened with COVID-19 patients both now and in the inevitable future surges of infection. The ventilator using AMBU bag, developed in this project, can be life saving unit during medical emergencies. Emergency oxygen supply will be provided until patient receives any medical aid. The gear motor used is made to push the AMBU bag to create air pressure, simultaneously the heart pulse and oxygen saturation level of the patient is monitored. The developed portable ventilator can be operated by any less skilled person in case of medical emergency.

8. SCOPE FOR FUTURE WORK

Based on the oxygen saturation level of patient the speed of the motorcanbe varied to provide sufficient oxygen to bring back the SPO2 level to normal.

9. REFERENCES

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